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THE DISTRIBUTION OF AN ENDEMIC BUTTERFLY LYCAENA HERMES

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ONE OF THE MOST INTERESTING of the endemic butterflies is *Lycaena hermes* (Edw.). Its known range extends fifty miles north of the Mexican border almost to Fallbrook, San Diego County, California, and south of the border almost one hundred miles to a point eighteen miles south of Santo Tomas, Baja, California, Mexico. In San Diego County it ranges inland to Pine alley, about forty miles from the Pacific Ocean.

Older literature and check-lists tended to overstate the range, i. e., California and Nevada, whereas all recently published information understates the range. In the light of present knowledge, the area occupied may be as large as the state of Connecticut. However, within this range its distribution is limited to pockets where the larval food plant occurs, so that the total area where the insect acually flies is probably not more than a fraction of one percent of the maximum area. Such limited distribution within a given range is not unique with endemics, being a common occurence among plants and animals.

Colonies of the Hermes Copper are closely confined to the vicinity of the host plant, *Rhamnus crocea* Nutt. Extensive collecting for over thirty years has failed to produce specimens beyond a short distance from the larval food plant. There is no observable tendency to migrate, to "hilltop," or otherwise to stray from these colonies, although there must be some inter-colony movement, probably by the males. Populations within the known range therefore depend on the distribution of the host plant, and there is certainly nothing novel about this among insects.

It is very difficult to analyse the complex factors which determine why a certain plant has been successful in a given spot, and why it has been able to out-compete all other plants for this particular place in the sun. In the case of *Rhamnus crocea,* the only consistent requirement seems to be a well drained soil of better than average depth, yet not deep enough to support trees. Such soils occur along canyon bottoms and on hillsides with a northern exposure; therefore, it is in these situations that *hemes* is generally found.

A notable point about *hermes* is that the host plant extends well beyond the range of this insect. *Rhamnus crocea,* in one form or another, extends to Mt. Diablo in the coastal ranges of California; along the foothills of the Sierra Nevada; on the Channel (Santa Barbara) Islands; and even into the Mojave Desert. Yet within its range in San Diego County, *hermes* tolerates greater climatic extremes than it would encounter in some of the contiguous coastal areas open to colonization, and in insular areas which might have been available at one time.

Freezing winters with snow are normal in Pine Valley at an elevation of 3800 feet, while summer temperatures of 105°F. are not uncommon in some of the foothill localities. To borrow an appropriate sentence from Hovanitz (1963), said of the distribution of *Argynnis idalia,* "The biological reasons for this restricted distributional range are not known." Biologists will appreciate how often this same conclusion must be drawn.

Nelson (1921) recognized a San Diegan Faunal District in northwestern Baja California which roughly corresponds with the area occupied by *hermes* in that Mexican state, but did not define the northern limits of this life zone in Southern California. A few species of plants appear to be restricted to about the area inhabited by *hermes,* but there is little to suggest, at least north of the border, that the area should be segregated from the Upper and Lower Sonoran life zones usually assigned to it. Nor has northwestern Baja California been shown to be an originator of new species, since the coastal fauna shows a close affinity to that of coastal Southern California, and the mountain fauna is simply an extension of the southern Sierran with the exception of a few instrusions (Rindge, 1948; Powell, 1958; Patterson and Powell, 1959; Truxal, 1960).

L. hermes is in a good state of balance in its environment. The season of emergence for the adults is very dependable, as is their presence every year in their select habitats. There is no wide fluctuation in numbers from year to year, although the current prolonged drought has reduced the populations in common with nearly all Lepidoptera. It would be difficult to believe that it is not autochthonous. Fossil evidence of insect distribution is so limited that it will probably never be known whether *hermes* ranged over a wider territory than now. It is an insect which seems to exhibit stability due to long occupation of its present habitat, yet it is difficult in the light of other biological evidence to view the present range as a refugium of some sort.

Concerning the genus *Lycaena,* Clench (1961) has stated, "A curious and possibly quite ancient genus, strongly developed in both the Palaearctic and the Nearctic regions, with a small handful of outliers — one in Guatemala, one in South Africa and several, most perplexing, in New Zealand." Perhaps this offers a clue, yet careful studies by Klots (1936) and Freeman (1936) have indicated that

hermes has affinities with other North American members of the genus. Klots says, "Evidently *hermes* is, structurally at least, far closer to *gorgon* and *heteronea* than to its tailed Nearctic congeners." Freeman placed *hermes* in his *xanthoides* group on the basis of the genitalia, together with *dione, rubidus,* and *editha.*

Another interesting thing about *hermes* is the use of a species of Rhamnaceae as the larval host. Most congeners feed on Polygonaceae (*Eriogonum, Rumex, Polygonum*); some of Rosaceae (*Potentilla*); some on Saxifragaceae (*Ribes*); and some on Ericaceae (*Vaccinium*), but this use of a Rhamnaceous plant is believed to be unique for the genus (Davenport and Dethier, 1937). The commonest source of nectar for the imagines is *Eriogonum fasciculatum* Benth., one of the Polygonaceae, and this plant is almost invariably present. Could this in some ancient time have served as the larval host?

One might reason that the failure of *hermes* to invade large areas which appear to be open to colonization might be due to prior occupation of particular ecological niches by another species (competitive exclusion). The unusual food plant which is not used in other areas by any member of the genus would seem to rule this out. Or, if one wishes to consider *hermes* as the victim of some complex. predator-parasite relationship which grew up around one of the congeners and favored it over *hermes, Lycaena* (*Tharsalea*) *arota* would be the most logical candidate. This species appears to be at the extreme southern limit of its range in San Diego County as evidenced by the few specimens ever taken. Since it feeds on *Ribes,* there is no direct competition, and the hypothesis becomes even more dubious from the fact that *hermes* lives sympatrically, or at least there are zones of contact along watercourses with *Lycaena helloides* and *L. xanthoides.* These should reasonably be expected to furnish whatever environmental pressures that *arota* might.

There is rather general belief that *hermes* is in a last ditch struggle for survival in San Diego County. This isn't true! Colonies have survived in areas that have been overrun with houses for many years; in areas being grazed by livestock; in areas being farmed (avocado orchards); and in areas which have been burned-over with some frequency. The map, Fig. 1, shows the wide distribution of known colonies which should ensure survival for the foreseeable future. This map should not be regarded as a complete record of distribution, since accessibility by road has been the main factor in locating colonies.

The insect has been beautifully illustrated in Comstock's "Butterflies of California" and his poetic description of the butterfly in nature is worth repeating. He says, "It is a fascinating little sprite as it darts about in the sunlight, or sports is showy colors while balanced on a tuft of wild buckwheat." As for the flight period, my earliest

record is May 20, 1934, and the latest is July 20 at Alpine by George Field. Records from several hundred captures show peak flight about June 20, but the best time to collect males is about June 10, and for the females about June 20. Field captures show a large preponderance of males (85%), but this a probably a false indication of the actual sex ratio because of the more retiring habits of the females, and because of their tendency to flee directly from the place of disturbance so that they are quickly lost to sight. However, the percentage of females increases late in the flight period in common with many butterflies. The males practice territorialism, but are not very aggresive about it. They will patrol a section of flyway, or watch it from a vantage point, often on the host plant, but from any suitable perch. Both sexes visit flowers avidly, and the blossoms of *Eriogonum fasciculatum* supply the bulk of nectar.

The species is single-brooded and spends about two-thirds of its life in the egg stage. It aestivates and hibernates in the ovum, and the hatching of one egg was observed under field conditions on March 16. Mature larvae were recovered by beating the host plant on May 24 near Lyons Peak, where the season is delayed due to elevation. The egg, mature larva, and pupa have been illustrated by Comstock and Dammers (1935). Females oviposit readily in captivity, but unless the ova are kept on a living plant, they fail to hatch. The reason for this is not known, but may simply be dessication. Nothing in this life history sets *hermes* apart in any remarkable way from other members of the genus, although several are multivoltine.

As a generalization, most endemics are univoltine (consider the alpine relicts) but there are numerous exceptions. A good example is *Strymon avalona* Wright, another interesting endemic, which is confined to Santa Catalina Island off the southern California coast despite the fact that its food plant, *Hosackia* (*Lotus*) *argophylla* Gray, is more widespread. This insect has a succession of broods. The biological reasons for its restricted distributional range are not known, but are easier to deal with than is the case with *hermes,* since insular, alpine, acid bog, or other types of endemism offer the biologist some solace during the brief instant in evolutionary time that he is around to observe distribution.

Populations of the Hermes Copper in each colony are not great, probably numbering in the hundreds. Six sample counts taken at random from field notes for 1955 to 1959 show the capture of 69 specimens in 405 minutes, about 6 minutes per catch. Any day in which 50 specimens are taken can be regarded as exceptional. It is entirely fair to regard the insect as "not uncommon" as expressed by Clench (1961) — in fact, it falls comfortably into Clark's (1932) standard of "abundant" (where fifteen or more can be taken in an average day).

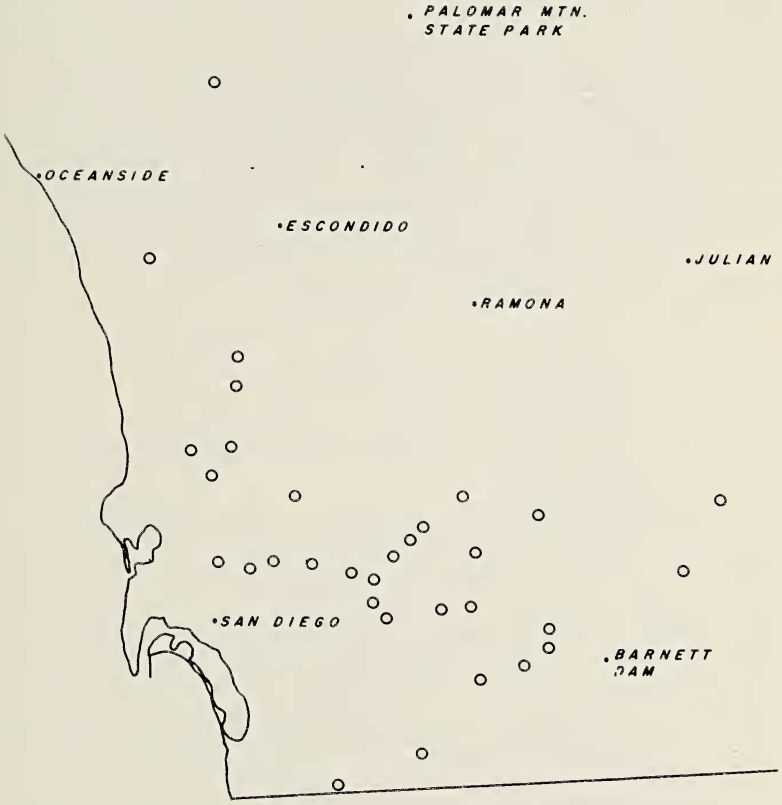

Fig. 1. Map showing the distribution of *Lycaena hermes* in San Diego county, California.

It has been stated previously that there must be some inter-colony movement. The basis for this is that differences among the populations are not readily observable, if indeed any exist. It must be admitted that no effort has been made to compare adequate series from different colonies to see if any segregation is evident. This would be an interesting study, but until it is made, it seems best to assume that gene flow throughout the entire range is adequate to prevent segregation.

If this is true, then the gene pool has some magnitude. Nevertheless, it seems likely that *hermes* is a conservative species, homozygous for many of its characters, variability being restricted by a close adaptation to a narrow environment. Barriers to spread appear to be intrinsic, that is, because of the inherited behavior patterns, the imagines "choose to remain" within very limited areas despite their ability to fly elsewhere, and presumably, to occupy larger territories (see Ehrlich, 1961). The chromosome number has not been published yet (N=24 for most species of the genus (Maeki and Remington, 1960) but this information is expected to be available soon.

Perhaps the distinctive facies and unusual food plant of *hermes* represent a genetic breakthrough which will result in time in a more widespread and successful species. Only time will tell whether the insect has retreated into a final refugium, the nature of which is not too evident, or whether it has the genetic resources eventually to expand its habitats.

That such expansion is possible has been demonstrated in a spectacular way by *Paratrytone melane melane* (Edw.) which was not recorded from San Diego County prior to 1941. Wright (1930) said, "Further collecting in wooded areas of the county may produce this species." Gunder (1930), in his now classic checklist of the butterflies of Los Angeles County wrote, "Never seemingly abundant in one locality, but may be had, several at a time each year." Rindge (1948) recorded this insect from southern Lower California, but this is now regarded as a distinct and undescribed sub-species (Mac Neill, 1962).

I first encountered this skipper on July 20, 1941, when two specimens were collected near El Cajon, California. Visits to the same spot July 23, 24, 25 and August 2 and 3 resulted in fifteen more specimens, and show my interest in what I thought was a once-in-a-lifetime chance. Other collectors also reported finding this species for the first time in San Diego that year. On October 5, 1941, a specimen was taken in the desert at Mason Valley, San Diego County. Since then, quite contrary to my expectations, this insect has become one of the very common skippers in my garden, flying from February to December. Powell (1958) records it from northwestern Baja, California in what I believe to be a further extension of this same population explosion.

This is an example of an insect which suddenly expanded into and occupied contiguous areas which are evidently well suited to it. It is not the purpose of this article to discuss this interesting phenomenon, but simply to point out that extensions of range are possible, and that it may be the privilege of the lepidopterist to see it happen in his own yard.

SUMMARY

The known range of *Lycaena hermes* (Edw.) extends from fifty miles north of the Mexican border in San Diego County to one hundred miles south of the border in Baja California. The insect occurs in colonies around the foodplant *Rhamnus crocea,* but has failed to invade other areas that appear suitable for reasons that are not known. The life history and field behavior are not unusual. The species is believed to be autochthonous and conservative, perhaps in a final refugium, but spread to other areas is possible, as has been demonstrated by *Paratrytone melane* (Edw.)

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